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THE FLORA AND NATURAL HISTORY OF WOODS PRAIRIE, A NATURE RESERVE IN SOUTHWESTERN MISSOURI

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Woods Prairie is a scenic and rare refuge of unplowed native tallgrass prairie on the northwestern fringe of the Ozarks bioregion in southwestern Missouri. This isolated 40-acre prairie remnant near the town of Mt. Vernon was part of a 1,700-acre homestead settled in 1836 by John Blackburn Woods of Tennessee. For four generations, the Woods family carefully managed the prairie while protecting it from the plow as all other nearby prairies were destroyed. By 1999, less than 40 acres of the original vast prairie remained, and John's great granddaughter, Mary Freda (Woods) O'Connell, sold it to the Ozark Regional Land Trust (ORLT, Carthage, MO), to be protected in perpetuity as a nature reserve for public study and enjoyment. ORLT, a non-profit conservation organization founded in 1984 to protect the unique natural features of the Ozarks, completed the purchase on May 27, 1999 through a unique, complex scheme detailed in Thomas and Galbraith (2003). The refuge was named "Woods" Prairie in honor of the family that protected it for 163 years.

DESCRIPTION OF WOODS PRAIRIE

GENERAL BACKGROUND.—This high-quality prairie relic supports an excellent diversity of native and scarce prairie plant and animal species, and features numerous well-developed Mima Mounds. Woods Prairie is ecologically and biologically significant because it is the one of the southeasternmost prairie relics remaining as the Osage Plains

transition into the more forested Ozark Mountains toward the southeast (other small prairie remnants in the Missouri Ozarks occur as far eastward as Howell County). Because this prairie is isolated and on the edge of the "normal" range of prairie in southwest Missouri, its value as a reserve of species and genes of great importance to prairie biodiversity has been recognized. Woods Prairie is also of interest botanically because it had not been burned for many decades; rather, it was maintained by haying every August without being fertilized. The annual haying regimen maintained an excellent diversity of grasses and forbs over the years, but left the soil and vegetation in a somewhat weakened condition. Grasses grew short and few species of forbs or grasses were flowering or fruiting prolifically. Fire was reintroduced to the prairie soon after its acquisition by ORLT in 1999, which we believe has substantially improved the health and vigor of the majority of plant species as well as the overall biodiversity of the prairie ecosystem.

Decades ago, a 6.5-acre section along the low-lying northern boundary of the 40-acre property was converted into a tall fescue (*Festuca arundinacea*) pasture and fenced off. This area contains two moderately-eroded drainage channels along with two small ponds (one ephemeral), and has been used for haying and cattle grazing. Nevertheless a small number of prairie forbs has persisted in this area, and a restoration project to recover this portion of the prairie is imminent. This interior pasture fence, as well as much of the perimeter fence, had grown up in trees and brush over the past 20–25 years (as determined by tree rings). Much of this woody vegetation has already been removed. ORLT expects to accomplish the complete restoration of the entire 40-acre prairie by 2007. Plant collections were made from these areas (pasture and treed fenceline) for this study, but as the restoration progresses, several of the nongrassland taxa listed in this report may no longer be found on the refuge. Additional details on Woods Prairie, its history, and significance can be found in Thomas (1999) and Missouri Department of Conservation (2003).

LOCATION.—Woods Prairie is located in southwestern Missouri, four miles east of Mt. Vernon, in Lawrence County, along the south side of Farm Road 2125, and ¾ mile west of Highway K (37° 15' latitude; 93° 43' longitude). The property is a square 40 acres (¼ × ¼ mile) contained by the access road on the north and cattle pastures on the other three sides.

TERRESTRIAL COMMUNITY CLASSIFICATION.—Woods Prairie is generally classified as a "dry-mesic chert prairie" with a typical tallgrass prairie vegetation (Missouri Department of Conservation, Natural Heritage Database, pers. comm.). This community is listed as "S3" (rare and uncommon in the state) by the Missouri Natural Heritage Program (2005). The prairie also has an area of "dry-mesic limestone/dolomite prairie" in the northwestern corner and probably some "hardpan prairie" on the high flat areas to the southeast. Both of these communities are listed "S2" (imperiled in the state). The lower, wetter areas on the north with ephemeral standing and flowing water may have been "wet-mesic prairie" with scattered trees and shrubs such as willow (*Salix* spp.), but since most of the native vegetation on that part of the property is gone, the presettlement vegetation is difficult to determine. The wet-mesic prairie community is listed as "S1" (critically imperiled in the state).

PHYSIOGRAPHY, TOPOGRAPHY, AND HYDROLOGY.—Woods Prairie is situated within the Springfield Plateau region of the Ozark Plateau Physiographic Province. This area is mostly an undulating to rolling plain over Mississippian cherty limestone bedrock with karst features. Nigh and Schroeder (2002) placed Woods Prairie in the "Spring River Prairie/Savanna Dissected Plain" Landtype Association within the Springfield Plain Subsection of the Ozark Highlands Ecological Section. The property exhibits a general southeast to northwest gradient descending from a high of 1,335 ft above sea level at the southeastern corner to a low ephemeral drainage at 1,300 ft in the northwestern corner, and with a brief rise back to 1,310 ft beyond this drainage to the far northwestern corner of the property. Approximately 40 Mima Mounds of various stages and sizes are scattered somewhat randomly across the prairie. A significant low swale cuts across the prairie from southeast to northwest near the center of the property. Surface water from Woods Prairie follows this southeast to northwest gradient, entering two ephemeral drainage channels on the north. The first cuts across the northeastern corner of the property (flowing east to west) and a second, larger drainage traverses the northwest corner (flowing north to west). Both of these drainages have moderate erosion. Flooding in this area is occasional but short-lived. Surface water exiting Woods Prairie forms the headwaters of Williams Creek, which continues west as part of the major Spring River Watershed. Only 1.5 miles to the east of Woods Prairie, the

terrain, geology, and soils undergo a sudden change from rolling hills into steep, rugged Ozark hills and valleys.

LANDSCAPE.—The region in which Woods Prairie occurs is now dominated by cattle farms and tall fescue grass used as forage. Poultry farms and housing developments continue to expand in the area as the size of individual property holdings are rapidly decreasing. Scattered small pockets of native prairie vegetation persist in a few locations in the area, such as ditches and fence rows, but none are significant enough to be called a prairie. The nearest remaining viable prairie is Mt. Vernon Prairie, a 40-acre remnant owned by The Nature Conservancy about five miles to the northwest. The nearest known remaining prairies to the southeast are Tingler Prairie Conservation Area, a wet-mesic prairie in Howell County, Missouri, and Baker Prairie Natural Area, a chert prairie in Harrison, Arkansas, both about 100 air-miles away.

SOILS.—The soils at Woods Prairie are of the Hoberg-Keeno-Creldon Association (Hughes, 1982). This soils association contains deep, moderately well-drained, gently to moderately sloping soils on upland ridges, terraces, and narrow flood plains over a cherty limestone residuum. Four distinct soil types within this Association are present at Woods Prairie (Hughes, 1982):

1) Creldon silt loam (fine, mixed, mesic Mollic Fragiudalfs) is the most dominant soil type, and covers about a third of the property on the southeastern corner, which is the highest, most level area of the prairie. These soils formed from a thin mantle of loess or other loamy materials, and loamy or clayey residuum weathered from cherty limestone under prairie vegetation. Creldon is typically a deep, gently sloping, moderately well-drained, upland soil with a fragipan at 18–36 inches. This fragipan causes a perched watertable to be present in most years from December through April and leads to frequent excessive dryness in summer.

2) Hoberg silt loam (fine-loamy, siliceous, mesic Mollic Fragiudalfs) also covers about a third of the prairie in a swath across the middle from northeast to southwest, and also on the extreme northeastern and northwestern corners. These soils formed in a thin mantle of loess and loamy or clayey residuum weathered from cherty limestone under prairie vegetation. Hoberg is a deep, gently sloping, moderately well-

drained soil on uplands and terraces, with a fragipan at 16–36 inches. This fragipan causes a perched watertable to be present in most years from December through March, and susceptibility to droughtiness in summer.

3) Pembroke silt loam (fine-silty, mixed, mesic Mollic Paleudalfs) is present on a small section (about 10%) of the preserve in the lower north-central portion of the prairie. These soils formed in residuum or in thin loess or alluvium and residuum weathered from limestone under prairie vegetation. Pembroke is typically a deep, gently sloping, well-drained soil on uplands and stream terraces, with moderate permeability and a high water-holding capacity.

4) A Secesh-Cedargap silt loams association occupies the two low, ephemeral water drainage areas in the northern portion of the refuge. Secesh silt loam (fine-loamy, siliceous, mesic Ultic Hapludalfs) formed in old, stratified, loamy and cherty-loamy alluvium under deciduous forest vegetation. Cedargap silt loam (loamy-skeletal, mixed, mesic Cumulic Hapludolls) formed in silty and clayey alluvium containing a high percentage of chert fragments under prairie and scattered deciduous forest vegetation. The soils in this association are deep, nearly level, well-drained to somewhat excessively-drained soils on stream terraces and flood plains.

Three soil samples were collected from Woods Prairie on 23 June 2004 and submitted to the University of Missouri-Columbia's Soil Testing Laboratory for nutrient analysis. The prairie had not been burned during the previous year. Sample 1 was collected within the Hoberg silt loam area generally in the center of the prairie. Sample 2 was collected within the low swale that cuts across the central Hoberg soil from southeast to northwest. Sample 3 was collected in the highest Creldon silt loam area on the southern and southeastern side. Results follow:

Soil Sample Description	pH	OM[1]	CEC[2]	Neutr[3]	P[4]	K[4]	Ca[4]	Mg[4]
1) Hoberg–central prairie	6.1	4.9	12.6	2.0	6	111	3862	190
2) Hoberg–low swale	5.1	5.0	14.7	6.5	5	120	2893	184
3) Creldon–south	5.7	4.9	13.6	3.5	5	110	3517	269

[1] Organic Matter (%)
[2] Cation Exchange Capacity (meq/100g)
[3] Neutralizable Acidity (meq/100g)
[4] Phosphorous, Potassium, Calcium, Magnesium (lbs/acre)

These laboratory results reveal that P levels are very low, and K and Mg levels are low, almost certainly a consequence of the repeated annual haying that was conducted without supplemental chemical fertilization for many decades. The Ca levels and pH are normal, however it is interesting to note that the soils within the low swale are much more acidic than elsewhere. Organic matter (OM) is very high and excellent, as it should be in a healthy prairie, which probably results in a similarly high and very good CEC. Overall, Woods Prairie supports a healthy soil for the region, but one that is depleted of certain macronutrients.

CLIMATE.—The weather at Woods Prairie is temperate with both hot/cold and dry/wet extremes. The refuge is situated within USDA Hardiness Zone 6. Weather data collected and compiled at the University of Missouri–Columbia's Southwest Research Center, located 9 miles west of Woods Prairie, are presented (Crawford et al., 2004). Monthly precipitation and monthly high/low temperatures, averaged over the past 45 years, are shown in Figs. 1 and 2, respectively. Within the past ten years (1995–2004), weather extremes include a high temperature of 106˚F in September 2000, a low temperature of -13˚F in January 1997, a maximum annual rainfall of 57.10 inches in 2004, and a minimum annual rainfall of 37.50 inches in 2000. The mean annual rainfall over the past 45 years is 43.24 inches.

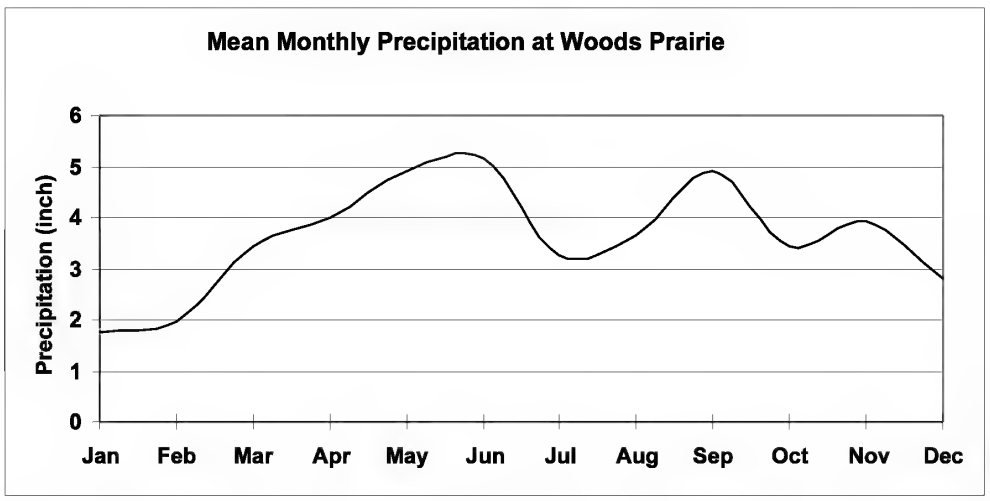

Fig. 1. Mean monthly precipitation at Woods Prairie. Weather data collected and compiled at University of Missouri–Columbia's Southwest Research Center, located 9 miles west of Woods Prairie. Data averaged over 45 years (1960–2004).

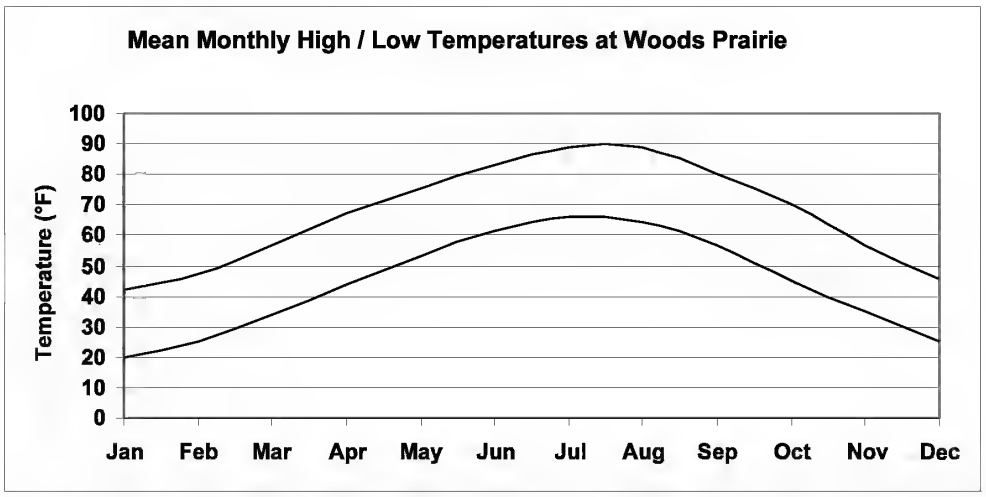

Fig. 2. Mean monthly high/low temperatures at Woods Prairie. Weather data collected and compiled at University of Missouri–Columbia's Southwest Research Center, located 9 miles west of Woods Prairie. Data averaged over 45 years (1960–2004).

EARLY HUMAN PRESENCE

Fig. 3. Kings Point (ca. 3,100–3,600 BP) found on the southeastern portion of Woods Prairie in 2005.

Two prehistoric human artifacts were found in 2005 in the southeastern upland part of Woods Prairie. The first (Fig. 3) is a heat-treated, corner-notched dart point with a triangular blade that was thrown with a wooden atlatl. It is believed to be a "Kings" point (Sandstrom and Ray, 2004, also Jack Ray, pers. comm.), estimated to be 3,100–3,600 years old, that was made and used by people of the Late Archaic Period (3,000–5,000 BP). The second artifact is a heat-treated, serrated blade fragment with attributes of a large basal-notched "Calf Creek" point, estimated to be 4,700–5,300 years old. This point was made and used by people of the Middle Archaic Period (5,000–7,000 BP) and was probably either for a hand-held spear or a dart thrown with an atlatl. Of course, we cannot know with certainty if the local landscape was prairie during those times, but we do know that ancient peoples walked and hunted on what is now Woods Prairie.

FAUNA

The former owner of Woods Prairie recounted common sightings of now-rare prairie-dependent animals on the property as late as the 1960s, including prairie chickens (*Tympanuchus* spp.), jack rabbits (*Lepus* spp.), and joint snakes (presumably the western slender glass lizard, *Ophisaurus attenuatus attenuatus*). The prairie chicken and jack rabbit are now extirpated from the region. The glass lizard may possibly survive at Woods Prairie, but has not been seen for decades. The ornate box turtle (*Terrapene ornata ornata*) is another increasingly-rare reptile that presently thrives at the prairie. Several scarce grassland birds continue to visit and possibly nest on Woods Prairie, including Henslow's sparrow (*Ammodramus henslowii*) [classified "S2" (imperiled in the state)] (Missouri Natural Heritage Program, 2005), grasshopper sparrow (*Ammodramus savannarum*), northern bobwhite quail (*Colinus virginianus*), and dickcissel (*Spiza americana*). An unusual ant (*Pheidole dentata*), known from only one other Missouri location (Prairie State Park), was identified. The threatened regal fritillary butterfly (*Speyeria idalia*) [classified "S3" (rare and uncommon in the state)] is almost certainly present at the prairie but has not been positively confirmed. Pink katydids (most likely the western round-winged katydid, *Amblycorypha parvipennis*) also are seen occasionally in the prairie.

METHODS

We began collecting and documenting plants at Woods Prairie in 1998, before it was purchased by ORLT, and continued through 2005. Generally, every two or three weeks throughout the growing seasons, collections were made and taxa determined. We collected on all 40 acres of the property including prairie, pasture, drainage, and treed fenceline. Many introduced and non-grassland taxa were collected or documented without a collection, but we did not attempt to catalogue all such taxa. In some cases, taxa with very few individual plants were not collected to avoid harming the population, but were nevertheless documented. Several specimens were submitted to botanists at the Missouri Botanical Garden for confirmation of their determinations. No previous botanical records specifically from Woods Prairie are known.

Nomenclature for the monocots, ferns, and conifers follows that of Yatskievych (1999), whereas dicots are referenced according to Yatskievych and Turner (1990). Some older synonyms of dicots found

in Steyermark (1963), and in rare cases newer dicot names are included in parentheses. Bryophyte names are referenced according to Crum and Anderson (1981) and Crum (1991). New Lawrence County records at Woods Prairie were determined from maps in Yatskievych (1999) for monocots, and Steyermark (1963) for dicots. County records for mosses were determined from Darigo (unpublished checklist and pers. comm.), and liverwort and hornwort county records were ascertained from Gier (1955) and Timme and Redfearn (1997). Notation that a vascular species is considered introduced is based on Yatskievych and Turner (1990). Vouchers were deposited at the following herbaria: MO (Missouri Botanical Garden), HPH (Holmberg Personal Herbarium, Krakow, MO), and UMO (Dunn-Palmer Herbarium, University of Missouri–Columbia).

RESULTS AND DISCUSSION

For such a small refuge (33.5 acres of native prairie and 6.5 acres of pasture and treed fenceline) a thriving botanical diversity was found. A total of 228 plant taxa in 65 families was documented. Incredibly, 56 of these taxa are county records, likely an artifact of the isolation of this prairie from larger prairie landscapes and perhaps the possibility that Lawrence County simply may not have been previously well-collected. Mosses comprise 16 taxa in 11 families; liverworts two taxa in two families; and hornworts, ferns, and conifers one taxon each. Flowering plants comprise 207 taxa in 49 families, including 167 native grassland taxa, 15 native nongrassland taxa, and 25 introduced taxa. For the most part, the introduced taxa found at Woods Prairie are widespread and common in the region, and do not presently threaten the integrity and biodiversity of the prairie.

The Mima Mounds apparently create subtle microenvironments for plants by creating variations in topography, drainage, and soils, which appear to be deeper and more friable than those of surrounding areas. Plant growth in general tends to be more lush and vigorous on and near the mounds. Certain plant species tend to favor one aspect or another of the mounds, whereas other species are rarely found growing on or near them. As an example, *Astragalus distortus* is a scarce plant on Woods Prairie that was found only on the south (hotter, drier) side of Mima Mounds.

Among the collections, two species are of conservation concern in Missouri (Missouri Natural Heritage Program, 2005): 1) *Camassia angusta*, which is abundant in the southwestern portion of Woods

Prairie, is classified "S3" (rare and uncommon in the state); 2) The moss *Ephemerum crassinervium* var. *crassinervium* is classified "S?" (uncertain status in the state). A number of additional taxa, such as *Potentilla arguta*, *Silene regia*, *Astragalus crassicarpus*, *Gentiana puberulenta*, and *Anemone caroliniana* are not presently listed as being of conservation concern in Missouri, but are listed as threatened or endangered in neighboring states.

ANNOTATED CHECKLIST OF THE FLORA

Collectors: **Gibson** (Sam Gibson), **Holmberg** (Nels Holmberg), and **Thomas** (Andrew L. Thomas). Herbaria where specimens deposited: **MO** (Missouri Botanical Garden), **HPH** (Holmberg Personal Herbarium), **UMO** (Dunn-Palmer Herbarium, University of Missouri–Columbia).

The following symbols, bolded and in parentheses, provide information as to the rarity of a taxon, its location at the refuge, and whether it is indigenous or introduced:

RA	Rare
CR	County record
IN	Introduced species
NG	Non-grassland species but indigenous to region
PR	Found in main prairie
PS	Found in north pasture area
WE	Found in wooded edge of prairie

Mosses

Amblystegiaceae

Campylium chrysophyllum, curved leaf moss (**PR**) *Holmberg WP2* (HPH).

Brachytheciaceae

Brachythecium laetum, common cedar moss (**PR**) *Holmberg WP12* (HPH).

Steerecleus serrulatus, twisted tip moss (**PR**) *Holmberg WP19* (HPH).

Bryaceae

Bryum caespiticium, long-celled thread moss (**PR**) *Holmberg WP1* (HPH).

Bryum pseudotriquetrum, fall clustered thread moss (**PR**) *Holmberg WP20* (HPH).

Entodontaceae

Entodon seductrix, glossy moss (**WE**) *Holmberg WP17* (HPH).

Ephemeraceae

Ephemerum crassinervium var. crassinervium, an ephemeral moss (**RA, CR, PS**) *Holmberg 665* (MO).

Fissidentaceae

Fissidens dubius, a plume moss (**PR**) *Holmberg WP13* (HPH).

Funariaceae
Funaria hygrometrica, cord moss (**WE**) *Holmberg WP4* (HPH).
Physcomitrium pyriforme, urn moss (**PR**) *Holmberg WP14* (HPH).

Hypnaceae
Homomallium adnatum, a moss (**WE**) *Holmberg WP18* (HPH).

Leskeaceae
Leskea gracilescens, slender moss (**WE**) *Holmberg WP3* (HPH).

Orthotrichaceae
Orthotrichum pumilum, orthotrichum moss (**WE**) *Holmberg WP15* (HPH).

Pottiaceae
Astomum muehlenbergianum, mouthless pygmy moss (**CR, WE**) *Holmberg 320* (MO).
Barbula unguiculata, claw leaf moss (**PR**) *Holmberg WP5* (HPH).
Weissia controversa, controverted green moss (**CR, PR**) *Holmberg 25* (MO).

Liverworts
Codoniaceae
Fossombronia brasiliensis, a leafy liverwort (**CR, PS**) *Holmberg 664* (MO).

Jubulaceae
Frullania eboracensis, a leafy liverwort (**WE**) *Holmberg WP16* (HPH).

Hornworts
Anthocerotaceae
Anthoceros laevis ssp. *carolinianus*, a hornwort (**CR, PS**) *Holmberg 663* (MO).

Ferns
Ophioglossaceae
Botrychium virginianum, rattlesnake fern (**PR**) *Gibson 3385* (MO**).**

Conifers
Cupressaceae
Juniperus virginiana, red cedar (**WE, NG**).

Flowering Plants
Acanthaceae
Ruellia humilis var. *humilis*, wild petunia (**PR**) *Gibson 3431* (MO).
Ruellia humilis var. *longiflora*, wild petunia (**CR, PR**) *Gibson 3478* (MO).

Anacardiaceae
Rhus copallina, winged sumac (**PR, WE**).
Toxicodendron radicans, poison ivy (**WE, NG**).

Apiaceae (Umbelliferae)
Daucus carota, wild carrot (**CR, IN, PR**) *Gibson 3446* (MO).
Eryngium yuccifolium, rattlesnake master (**PR**) *Gibson 3487* (MO).
Polytaenia nuttallii, prairie parsley (**PR**) *Gibson 3460* (MO).
Zizia aurea, golden Alexanders (**PR**) *Gibson 3396* (MO).

Apocynaceae
Apocynum cannabinum, prairie dogbane (**CR, PR**).

Asclepiadaceae
Asclepias hirtella, prairie milkweed (**PR**) *Gibson 3442* (MO).
Asclepias tuberosa ssp. *interior*, butterfly weed (**PR**) *Gibson3444* (MO).
Asclepias verticillata, whorled milkweed (**PR**) *Gibson 3560* (MO).
Asclepias viridiflora var. *viridiflora*, green milkweed (**PR**) *Gibson 3483* (MO).

Asteraceae (Compositae)
Achillea millefolium var. *lanulosa*, yarrow (**CR, PR**) *Gibson 3433* (MO).
Ambrosia artemisiifolia, common ragweed (**NG, PS**) *Holmberg 682* (MO).
Antennaria neglecta, pussytoes (**CR, PR**) *Gibson 3369* (MO).
Aster ericoides var. *prostratus*, wreath aster (**CR, PR**) *Gibson 3523* (MO), *Thomas 43* (MO).
Aster laevis var. *laevis*, smooth aster (**CR, PR**) *Gibson 3531* (MO).
Aster lanceolatus var. *lanceolatus* (*A. simplex* var. *ramosissimus*), tall white aster (**CR, PR**) *Gibson 3521* (MO).
Aster oolentangiensis (*A. azureus*), azure aster (**CR, PR**) *Gibson 3522* (MO).
Aster paludosus ssp. *hemisphericus*, southern prairie aster (**PR**) *Gibson 3490* (MO).
Aster sericeus, silky aster (**CR, PR**) *Gibson 3529* (MO).
Berlandiera texana, green eyes (**PR**) *Gibson 3459* (MO).
Cacalia plantaginea (*C. tuberosa*), Indian plantain (**CR, PR**) *Gibson 3445* (MO).
Coreopsis grandiflora var. *grandiflora*, bigflower coreopsis (**CR, PR**) *Gibson 3414* (MO).
Coreopsis palmata, finger coreopsis (**PR**) *Gibson 3447* (MO).
Echinacea pallida, pale purple coneflower (**PR**) *Gibson 3434* (MO).
Erigeron strigosus var. *strigosus*, daisy fleabane (**PR**) *Gibson 3406* (MO).
Euthamia gymnospermoides (*Solidago gymnospermoides*), grass-leaved goldenrod (**CR, PR**) *Gibson 3524* (MO).
Helenium amarum, bitter sneezeweed (**PR**).
Helenium flexuosum, sneezeweed (**PR**) *Gibson 3471* (MO).
Helianthus mollis, ashy sunflower (**PR**).
Hieracium longipilum, hawkweed (**CR, PR**) *Gibson 3485* (MO).
Krigia caespitosa (*Serinia oppositifolia*), dwarf dandelion (**PR**) *Gibson 3544* (MO).
Krigia dandelion, potato dandelion (**PR**) *Gibson 3399* (MO).
Leucanthemum vulgare var. *pinnatifidum* (*Chrysanthemum leucanthemum* var. *pinnatifidum*) ox-eye daisy (**IN, PR**) *Gibson 3407* (MO).
Liatris aspera, rough blazing star (**PR**) *Gibson 3505* (MO).
Liatris pycnostachya, gayfeather (**PR**) *Gibson 3488* (MO).
Liatris squarrosa, a blazing star (**PR**) *Gibson 3501* (MO).
Prenanthes aspera, rattlesnake root (**PR**) *Gibson 3514* (MO).
Pyrrhopappus carolinianus, false dandelion (**PR**).
Ratibida pinnata, grayhead prairie coneflower (**PR**) *Gibson 3468* (MO).
Rudbeckia hirta var. *pulcherrima*, black-eyed Susan (**PR**) *Gibson 3440* (MO).

Rudbeckia missouriensis, Missouri coneflower (**CR, PR**) *Gibson 3508* (MO).
Silphium integrifolium var. *integrifolium*, rosinweed (**PR**) *Gibson 3506* (MO).
Silphium laciniatum, compass plant (**PR**).
Solidago altissima, tall goldenrod (**PR**) *Gibson 3525* (MO).
Solidago missouriensis, Missouri goldenrod (**CR, PR**) *Gibson 3489* (MO).
Solidago ptarmicoides (*Aster ptarmicoides*), white upland aster (**CR, PR**) *Gibson 3507* (MO).
Solidago rigida, stiff goldenrod (**PR**) *Gibson 3502* (MO).
Solidago speciosa, prairie goldenrod (**PR**) *Gibson 3509* (MO).
Verbesina helianthoides, yellow crownbeard (**PR**) *Gibson 3449* (MO).
Vernonia arkansana (*V. crinita*), ironweed (**PR**) *Gibson 3491* (MO).
Vernonia baldwinii ssp. *baldwinii*, ironweed (**PR**).

Boraginaceae
Heliotropium tenellum, heliotrope (**PR**).
Lithospermum canescens, orange puccoon (**PR**) *Gibson 3370* (MO).
Lithospermum incisum, yellow puccoon (**PR**).
Myosotis verna (*M. virginica*), scorpion grass (**PR**).

Brassicaceae
Barbarea vulgaris var. *arcuata*, yellow rocket (**IN, PR**) *Gibson 3367* (MO).
Draba brachycarpa, whitlow grass (**PR**) *Holmberg WP21* (HPH).
Lepidium virginicum, poor man's pepper grass (**IN, PR**) *Gibson 3453* (MO).

Caesalpiniaceae (Leguminosae)
Gleditsia triacanthos, honey locust (**WE, NG**).

Campanulaceae
Lobelia inflata, Indian tobacco (**PR**) *Gibson 3412* (MO).
Lobelia spicata var. *spicata*, spiked lobelia (**PR**) *Gibson 3450* (MO).

Caprifoliaceae
Lonicera japonica, Japanese honeysuckle (**CR, IN, WE, PR**).
Symphoricarpos orbiculatus, buckbrush (**WE, NG**).

Caryophyllaceae
Arenaria serpyllifolia, thyme-leaved sandwort (**CR, IN, PR**) *Gibson 3540* (MO).
Cerastium nutans, nodding chickweed (**IN, PR, PS**) *Gibson 3541* (MO).
Dianthus armeria, Deptford pink (**IN, PR**) *Gibson 3428* (MO).
Silene regia, royal catchfly (**CR, PR**) *Gibson 3479* (MO).

Clusiaceae (Guttiferae, Hypericaceae)
Hypericum punctatum (*H. punctatum* var. *punctatum*), spotted St. John's-wort (**PR**) *Gibson 3492* (MO).

Commelinaceae
Tradescantia ohiensis, smooth spiderwort (**PR**) *Gibson 3403* (MO).
Tradescantia ohiensis × *tharpii* (**RA, PR**).
Tradescantia tharpii, dwarf spiderwort (**RA, PR**) *Gibson 3377* (MO).

Cyperaceae
Carex blanda, a sedge (**PR**) *Holmberg WP7* (HPH).
Carex brevior, a sedge (**PR**) *Holmberg WP6* (HPH).
Carex bushii, a sedge (**CR, PR**) *Gibson 3401* (MO).
Carex gravida, a sedge (**PR**) *Holmberg WP8* (HPH).
Carex leavenworthii, a sedge (**PR**) *Holmberg WP9* (HPH).
Carex meadii, a sedge (**CR, PR**) *Gibson 3535* (MO).
Carex normalis, a sedge (**PR**) *Holmberg WP11* (HPH).
Carex oligocarpa, a sedge (**PR**) *Holmberg WP10* (HPH).
Cyperus acuminatus, an umbrella sedge (**NG, PS**) *Holmberg 683* (MO).
Eleocharis acicularis, slender spike rush (**NG, PS**) *Holmberg 684* (MO**).**
Fimbristylis puberula (**CR, PR**) *Gibson 3546* (MO).
Scleria ciliata, hairy nut grass (**PR**) *Gibson 3559* (MO).
Scleria triglomerata, tall nut grass (**PR**) *Gibson 3415* (MO).

Ebenaceae
Diospyros virginiana, persimmon (**WE, NG**).

Euphorbiaceae
Crotonopsis elliptica (*Croton willdenowii*), rushfoil (**PR**) *Gibson 3510* (MO).
Euphorbia corollata, flowering spurge (**PR**) *Gibson 3441* (MO).
Phyllanthus caroliniensis, leaf-flower (**CR, NG, PS**) *Holmberg 685* (MO).

Fabaceae (Leguminosae)
Amorpha canescens, lead plant (**PR**) *G ibson 3456* (MO).
Astragalus distortus, bent milk vetch (**PR**) *Gibson 3389* (MO).
Astragalus crassicarpus var. *trichocalyx* (*A. mexicanus* var. *trichocalyx*), ground plum (**PR**) *Gibson 3368* (MO).
Baptisia bracteata (*B. leucophaea*), cream white indigo (**PR**) *Gibson 3393* (MO).
Dalea candida, white prairie clover (**PR**) *Gibson 3465* (MO).
Dalea purpureum, purple prairie clover (**PR**) *Gibson 3466* (MO).
Desmodium illinoense, Illinois tick clover (**PR**) *Gibson 3467* (MO).
Desmodium sessilifolium, tick clover (**PR**) *Gibson 3503* (MO).
Lespedeza capitata (*L. capitata* var. *capitata*), round-headed bush clover (**PR**) *Gibson 3517* (MO).
Lespedeza virginica, slender bush clover (**PR**) *Gibson 3526* (MO).
Orbexilum pedunculatum var. *pedunculatum* (*Psoralea psoralioides* var. *eglandulosa*), Sampson's snakeroot (**PR**) *Gibson 3405* (MO).
Stylosanthes biflora, pencil flower (**PR**) *Gibson 3461* (MO).
Tephrosia virginiana var. *holosericea*, goat's rue (**CR, PR**) *Gibson 3435* (MO).
Trifolium dubium, little hop clover (**CR, IN, PR**) *Gibson 3436* (MO).
Trifolium pratense, red clover (**IN, PR, PS**) *Gibson 3547* (MO).

Gentianaceae
Gentiana puberulenta (*G. puberula*), downy gentian (**PR**) *Gibson 3517* (MO).

Iridaceae
Sisyrinchium campestre, prairie blue-dyed grass (**PR**) *Gibson 3375* (MO).

Juncaceae
Juncus interior, inland rush (**CR, PR**) *Gibson 3551* (MO).
Juncus tenuis, path rush (**PR**).

Lamiaceae (Labiatae)
Lamium amplexicaule, henbit (**CR, IN, PR, PS**) *Thomas 44* (UMO).
Lamium purpureum, dead nettle (**IN, PR, PS**) *Gibson 3533* (MO).
Monarda fistulosa ssp. *fistulosa* (*M. fistulosa* var. *mollis*), wild bergamot (**PR**) *Gibson 3452* (MO).
Physostegia angustifolia, false dragonhead (**CR, PR**) *Gibson 3458* (MO).
Prunella vulgaris, self-heal (**PR**) *Gibson 3426* (MO).
Pycnanthemum tenuifolium, slender mountain mint (**PR**) *Gibson 3448* (MO).
Salvia azurea var. *grandiflora*, blue sage (**PR**) *Gibson 3520* (MO).
Scutellaria parvula (*S. parvula* var. *leonardi*), small skullcap (**PR**) *Gibson 3394* (MO).
Teucrium canadense var. *canadense* (*T. canadense* var. *virginicum*), germander (**PR**).

Lauraceae
Sassafras albidum, sassafrass (**WE, PR, NG**) *Thomas 46* (UMO).

Liliaceae
Allium canadense var. *canadeuse*, wild garlic (**PR**).
Camassia angusta, wild hyacinth (**RA, CR, PR**) *Gibson 3429* (MO).
Camassia scilloides, wild hyacinth (**PR**) *Gibson 3543* (MO).
Erythronium mesochoreum, prairie dogtooth violet (**PR**) *Gibson 3358* (MO).
Hypoxis hirsuta, yellow star grass (**CR, PR**) *Gibson 3376* (MO).
Nothoscordum bivalve, false garlic (**PR**) *Gibson 3372* (MO).

Linaceae
Linum sulcatum, grooved flax (**PR**) *Gibson 3484* (MO).

Malvaceae
Callirhoe digitata, fringed poppy mallow (**PR**) *Gibson 3455* (MO).

Mimosaceae (Leguminosae)
Schrankia nuttallii (*S. uncinata*), sensitive brier (**PR**) *Gibson 3433* (MO).

Moraceae
Maclura pomifera, Osage orange (**CR, IN, WE, NG**).
Morus alba, white mulberry (**IN, WE**).

Oleaceae
Fraxinus americana, white ash (**WE, NG**).

Onagraceae
Gaura longiflora (*G. biennis*), large-flowered gaura (**CR, PR**) *Gibson 3427* (MO).
Oenothera linifolia, sundrops (**PR**) *Gibson 3427* (MO).

Orchidaceae
Calopogon oklahomensis, prairie grass pink (**RA, CR, PR**) *Gibson 3557* (MO).
Spiranthes cernua, nodding ladies' tresses (**PR**) *Gibson 3530* (MO).

Spiranthes lacera, slender ladies' tresses (**PR**) *Gibson 3515* (MO).
Spiranthes vernalis, spring ladies' tresses (**CR, PR**) *Gibson 3481* (MO).

Oxalidaceae
Oxalis florida (*O. dillenii*), yellow wood sorrel (**PR**) *Gibson 3545* (MO).
Oxalis violacea, violet wood sorrel (**PR**) *Gibson 3386* (MO).

Phytolaccaceae
Phytolacca americana, pokeweed (**WE, NG**).

Plantaginaceae
Plantago lanceolata, English plantain (**IN, PR, PS**) *Gibson 3437* (MO).
Plantago virginica, hoary plantain (**PR, PS**) *Gibson 3402* (MO).

Poaceae (Gramineae)
Agrostis hyemalis, hair grass (**PR**) *Gibson 3549* (MO).
Andropogon gerardii, big bluestem (**PR**).
Andropogon virginicus, broomsedge (**PR**).
Bouteloua curtipendula, sideoats grama (**PR**) *Gibson 3486* (MO).
Bromus commutatus, hairy chess (**IN, PR, WE**) *Gibson 3554* (MO).
Dactylis glomerata, orchard grass (**IN, PS, PR**) *Thomas 45* (UMO).
Elymus virginicus, Virginia wild rye (**PR**) *Gibson 3562* (MO).
Elymus villosus, downy wild rye (**PR**) *Gibson 3457* (MO).
Festuca arundinacea, tall fescue (**IN, WE, PS, PR**) *Gibson 3548* (MO).
Koeleria macrantha, June grass (**PR**) *Gibson 3416* (MO).
Panicum oligosanthes, a panic grass (**PR**) *Gibson 3409* (MO).
Panicum virgatum, switch grass (**PR**) *Gibson 3512* (MO).
Poa compressa, Canada bluegrass (**IN, PR**) *Gibson 3553* (MO).
Schizachyrium scoparium, little bluestem (**PR**).
Setaria parviflora, knotroot foxtail (**PR**) *Gibson 3482* (MO).
Sorghastrum nutans, Indian grass (**PR**).
Sphenopholis obtusata, prairie wedgescale (**PR**) *Gibson 3550* (MO).
Sporobolus heterolepis, prairie dropseed (**PR**).
Stipa spartea, porcupine grass (**PR**) *Gibson 3408* (MO).
Tridens flavus, purpletop (**PR**) *Gibson 3511* (MO).
Tripsacum dactyloides, eastern gama grass (**CR, PR**) *Gibson 3430* (MO).
Vulpia octoflora var. *glauca*, sixweeks fescue (**IN, PR**) *Gibson 3417* (MO).
Vulpia octoflora var. *octoflora*, sixweeks fescue (**IN, PR**) *Gibson 3555* (MO).

Polemoniaceae
Phlox pilosa ssp. *pilosa*, downy phlox (**PR**) *Gibson 3398* (MO).

Polygalaceae
Polygala incarnata, pink milkwort (**CR, PR**) *Gibson 3561* (MO).
Polygala sanguinea, field milkwort (**CR, PR**) *Gibson 3451* (MO).

Portulacaceae
Claytonia virginica, spring beauty (**PR**) *Gibson 3359* (MO).

Primulaceae
Dodecatheon meadia var. *meadia*, shooting star (**PR**) *Gibson 3379, 3380* (MO).
Lysimachia lanceolata, loosestrife (**PR**) *Gibson 3438* (MO).

Ranunculaceae
Anemone caroliniana, prairie anemone (**PR**) *Gibson 3556* (MO).
Delphinium carolinianum ssp. *carolinianum* (*D. carolinianum* var *crispum*), Carolina larkspur (**CR, PR**) *Gibson 3413* (MO).
Ranunculus fascicularis (*R. fascicularis* var. *apricus*), early buttercup (**PR**) *Gibson 3360* (MO).
Ranunculus hispidus, hispid buttercup (**PR**).

Rhamnaceae
Ceanothus americanus var. *pitcheri*, New Jersey tea (**PR**) *Gibson 3439* (MO).

Rosaceae
Fragaria virginiana (*F. virginiana* var. *illinoensis*), wild strawberry (**PR**) *Gibson 3371* (MO).
Malus ioensis (*Pyrus ioensis*), wild crabapple (**PR**) *Gibson 3539* (MO).
Potentilla arguta, tall cinquefoil (**RA, CR, PR**) *Gibson 3454* (MO).
Potentilla recta, rough-fruited cinquefoil (**IN, PR**) *Gibson 3425* (MO).
Potentilla simplex var. *simplex*, common cinquefoil (**PR**) *Gibson 3395* (MO).
Prunus americana, wild plum (**WE, PR**) *Gibson 3538* (MO).
Prunus serotina, black cherry (**CR, WE, NG**) *Gibson 3537* (MO).
Rosa carolina (*R. carolina* var. *carolina*), pasture rose (**CR, PR**) *Gibson 3424* (MO).
Rosa multiflora, multiflora rose (**CR, IN, WE**).
Rubus flagellaris, dewberry (**WE, PR**) *Gibson 3565* (MO).
Rubus pensilvanicus, high-bush blackberry (**WE, PR**) *Gibson 3566* (MO).

Rubiaceae
Galium obtusum, bluntleaf bedstraw (**PR**) *Gibson 3473* (MO).
Galium pedemontanum, bedstraw (**CR, IN, PR, PS**) *Gibson 3534* (MO)—county record status based upon lack of any presently-published Lawrence County record for this species. The taxon was not included in Steyermark (1963).
Hedyotis crassifolia (*Houstonia minima*), small bluets (**PR**) *Gibson 3532* (MO).

Santalaceae
Comandra umbellata ssp. *umbellata* (*C. richardsiana*), bastard toadflax (**PR**) *Gibson 3387* (MO).

Scrophulariaceae
Buchnera americana, blue hearts (**CR, PR**) *Gibson 3470* (MO).
Castilleja coccinea, Indian paintbrush (**CR, PR**) *Gibson 3378* (MO).
Pedicularis canadensis, common lousewort, wood betony (**PR**) *Gibson 3373* (MO).
Penstemon digitalis, smooth beard-tongue (**PR**) *Gibson 3432* (MO).
Penstemon tubiflorus (*P. tubaefloris*), beard-toungue (**CR, PR**) *Gibson 3404* (MO).
Veronica arvensis, corn speedwell (**IN, PR**) *Gibson 3542* (MO).
Veronicastrum virginicum, Culver's root (**PR**) *Gibson 3480* (MO).

Solanaceae
Physalis virginiana, ground cherry (**PR**).

Solanum carolinense var. *carolinense*, horse nettle (**PR**) *Gibson 3469* (MO).

Ulmaceae
Celtis occidentalis, hackberry (**CR, WE, NG**).
Ulmus rubra, slippery elm (**CR, WE, NG**).

Valerianaceae
Valerianella radiata (*V. stenocarpa* var. *parviflora*), corn salad (**RA, CR, PR**) *Gibson 3397* (MO).

Violaceae
Viola pedata (*V. pedata* var. *linearíloba*), pansy violet (**PR**) *Gibson 3374* (MO).
Viola pedatifida, prairie violet (**PR**) *Gibson 3381* (MO).
Viola sagittata, arrow-leaved violet (**CR, PR**) *Gibson 3361* (MO).

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PLANT CHANGES FOR THE 2005 "MISSOURI SPECIES AND COMMUNITIES OF CONSERVATION CONCERN CHECKLIST"

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The Missouri Natural Heritage Program annually publishes a document called *Missouri Species and Communities of Conservation Concern Checklist* (Missouri Natural Heritage Program, 2004)(Checklist). Contained in the document is a listing of plants, animals, and natural communities that are tracked in the Natural Heritage Database (Database). Tracked taxa are ones for which data are requested for all Missouri observations. Botanists and other plant enthusiasts use the Checklist to determine if they will submit reports to the Database when they observe an uncommon plant species. Reporting forms are included in the Checklist.

A state ranking system is explained in the Checklist and ranks are given for each taxon in the list. Most plants in the Checklist are given the numerical ranks of S1, S2, or S3 based on rarity or threats, with S1 species considered the most critically imperiled. The ranks typically correlate with the number of known occurrences, using the following guidelines:

S1 5 or fewer occurrences
S2 6–20 occurrences
S3 21–100 occurrences

In addition to the numerical ranks, other ranks are used for specific situations, such as **SE** for exotic taxa, **SRF** for taxa falsely reported to occur in Missouri, **SH** for taxa not observed in the last 25 years or **SX** for taxa considered extirpated from the state.

The following is a list of changes in rank or taxonomy that have been made since the publication of the last Checklist in 2004. This brief listing is not intended to replace the reporting of significant plant finds that merit a more detailed account in this or other journals. These changes have been published in the recently released 2005 Checklist but with fewer details on the basis for the changes than are provided here. A complete Checklist for 2005 can be obtained by

contacting the Natural Heritage Program of the Resource Science Division at the author's address above and is also available at the web address: http://www.missouriconservation.org.

STATUS CHANGES

Acalypha deamii (Weath.) H.E. Ahles (large seeded mercury) from SH to S1 because there are extant records, which precludes the use of the SH rank. Recent collections were from riverbanks and bottomland forests in 1995 (St. Louis Co.) and 1998 (Greene and Pike counties).

Arabis glabra (L.) Bernh. (tower mustard) from S1 to SH because the most recent observation was more than 25 years ago, in 1979 on Grand Tower Island in Perry Co. (Mohlenbrock 1979).

Bromus latiglumis Hitchc. (a brome) from S2S3 to S3 based on the documentation of 20 extant sites in 11 counties, mostly since 1988. More sites will undoubtedly be located by those with a good search-image for the species.

Bromus nottowayanus Fernald (satin brome) from S2S3 to S3 based on the documentation of 26 extant sites in 14 counties, mostly since 1993. More sites will undoubtedly be located by those with a good search-image for the species.

Carex microdonta Torr. & Hook. (a sedge) from S1 to SH because the most recent observation was in 1971. Historically known from Barton, Clay, Osage, and Vernon counties. Dr. Paul McKenzie and this author searched unsuccessfully at the Osage County historical site in 2004.

Carex oklahomensis Mack. (Oklahoma sedge) from S2 to S3 based on the documentation of 19 extant sites from a number of prairies in the Osage Plains and Springfield Plateau. There are undoubtedly additional sites yet to be found in prairies with wet swales or stream terraces.

Carex stricta Lam. (tussock sedge) from S2 to S3 based on the documentation of 26 extant sites in 11 counties in recent years, many occurring in fens. More sites are expected as additional fens are discovered and surveyed.

Carex tetanica Schk. (rigid sedge) from S1 to S2 based on the documentation of 18 extant sites in 9 counties; most found since 1993, in fens.

Carex texensis (Torr.) L.H. Bailey (a sedge) from S1 to S2 based on the documentation of 17 extant sites in 9 counties. This species occurs in a variety of natural and disturbed habitats, from open-canopy forests to lawns and cemeteries.

Carex triangularis Boeck. (triangular sedge) from S1 to S2 based on the documentation of 10 extant sites from southeastern and central counties. Most sites are in wetlands or roadside ditches.

Carex willdenowii Schkuhr ex Willd. (Willdenow's sedge) from S1? to S1 based on the lack of new records from recent searches. Only known from an upland forest in Reynolds County where it was discovered by Bill Summers in 1995 (Summers, 1997).

Cyperus grayoides Mohlenbr. (an umbrella sedge) from S2 to S3 based on the documentation of 19 extant sites from sand prairies remnants in 4 southeastern counties since 1989 and the likelihood of finding additional sites in that region.

Cyperus polystachyos Rottb. var. *texensis* (Torr.) Fernald (many-spiked cyperus) from S2 to S2S3 based on the documentation of 14 extant sites, mostly since 1991, from sandy soils in New Madrid, Scott and Stoddard counties and the expectation of finding additional sites in various moist-soil plant communities in southeastern Missouri.

Echinacea angustifolia DC. var. *angustifolia* (narrow-leaved coneflower) from S1 to SH because most recent collections that were previously thought to be this taxon were determined to represent more common taxa upon reexamination. Several older specimens remain to be examined, but it may be that this taxon eventually will be considered introduced in Missouri.

Eragrostis reptans (Michaux) Nees (creeping love grass) from S1 to SH because the most recent observation was in 1976 at Squaw Creek National Wildlife Refuge (Holt County).

Gentiana andrewsii Griseb. var. *andrewsii* (closed gentian) from S1 to SH because the most recent observation was in 1950, a Steyermark

collection from Ste. Genevieve County. Most blue closed gentians in Missouri are attributable to *G. andrewsii* Griseb. var. *dakotica* Nelson.

Helenium virginicum S.F. Blake (Virginia sneezeweed) from S1 to S3 based on the documentation of 43 extant sites in 6 south-central counties. All but one of these sites was found in 2003 or 2004 by Bill Summers or Rhonda Rimer. The single exception is the Howell County site found by Steyermark in 1957 but until recently thought to represent a hybrid rather than *H. virginicum*.

Lipocarpha aristulata (Coville) G.C. Tucker (lipocarpha) from SU to SH because the most recent observation was in 1961 at a St. Louis railyard. Most other records are from southwest counties.

Malus angustifolia (Aiton) Michx. (narrow-leaved wild crab) from S1 to S2 based on the documentation of 8 extant sites from sandy soils in southeastern Missouri.

Najas flexilis (Willd.) Rostkov & F.W. Schmidt (thread-like naiad) from S1S2 to SH because the most recent observation was in 1920. Both the 1920 record and the single other record, from 1908, are from lakes in Boone County.

Ophioglossum crotalophoroides Walter (bulbous adder's tongue) from S1 to SH because the only Missouri record is from a cemetery in Thayer (Oregon County) in 1974.

Polygonum densiflorum Meissn. (dense-flower smartweed) from S1 to SH because the most recent observation was in 1973 and that site is considered destroyed by inundation following the construction of Mark Twain Lake. The next most recent record is from 1951 (Barton County).

Sagittaria platyphylla (Engelm.) J.G. Smith (ovate-leaved arrowhead) from SH to S1 based on a single extant record from a collection by Sherry Holmes from a Cape Girardeau ditch in 1993.

Schoenoplectus hallii (A. Gray) S.G. Sm. (Hall's bulrush) from S1 to S2 based on the documentation of 10 extant sites. Most of the recent observations have come from sandy-soil areas of Scott County on sites that are inundated during a portion of the year.

Scutellaria elliptica Muhl. var. *hirsuta* (Short) Fernald (hairy skullcap) from S1 to SH because the most recent observation was from a roadside dolomite glade in Jefferson County in 1978. The only two other records are from Cape Girardeau County in 1954 and 1976.

Solidago riddellii Frank (Riddell's goldenrod) from S2 to S3 based on the documentation of 21 extant sites, primarily in Ozark counties. We began tracking this species in the Database in 2003 and it is proving to occur in many Ozark fens.

Sphagnum margaritae Crum (peatmoss) from S? to SRF based on preparation of the moss treatment for the Flora of North America Project. Missouri specimens once attributed to this taxon have been determined to be other *Sphagnum* taxa.

Sporobolus airoides (Torr.) Torr. (alkali sacaton) from S1 to SH because the most recent observation was in 1976, from moist ground near a pond in Taney County. The only other Missouri records are from the late 1800s in Atchison and Jackson counties.

Viburnum lentago L. (nannyberry) from SH to S1 because a single extant record exists from a fen in Schuyler County from a collection by Maureen McHale in 2000.

ADDITIONS

Centaurea americana Nutt. (American basketflower) as SH based on research for the Flora of Missouri project that indicates that the species was considered native to southwest Missouri and was introduced further north and east. The only record located thus far from southwest Missouri dates to 1935, a Barry County collection by Steyermark.

Lycopus uniflorus Michx. (northern water horehound) as S2? because the species is currently known in Missouri from only one extant site (Harrison County) and five historical sites. The species may have been overlooked due to its similarity to other *Lycopus* and the fact that it was not included in Steyermark's *Flora of Missouri* (Steyermark, 1963). It may turn out to be more common, especially in northern Missouri.

DELETIONS

Tridens × *oklahomensis* (Feath.) Feath. ex Chase (Oklahoma fluff grass). Removed due to decision not to track hybrids. *Tridens* × *oklahomensis* is a rare sterile hybrid between *T. strictus* (Nutt.) Nash and *T. flavus* (L.) Hitchc. (Crooks and Kucera, 1973).

TAXONOMIC CHANGES

Anthoceros punctatus L. (a hornwort) to *Aspiromitus punctatus* (L.) Schljakov spp. *agrestis* (Paton) Schust.

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HOW FASTER TO MASTER THE *ASTER* DISASTER: A PRIMER ON THE CHANGING NOMENCLATURE OF MISSOURI ASTERS

George Yatskievych
Flora of Missouri Project

Modern plant systematists are botanical genealogists. Their work is often expressed as cladistic phylogenies (cladograms), which are branched diagrams that detail the relationships among taxonomic groups as lineages derived from hypothetical ancesters. The concept of a "natural" taxonomic group has come to mean a hypothesis that two or more taxa have a direct shared common ancestry. The tools used to develop these phylogenies are broad and often involve some combination of data from morphological, anatomical, cytological, phytochemical, and molecular studies.

Phylogenetic systematists tend to operate under a set of basic assumptions that may not be intuitive to those outside the field. The technical term for a phylogenetically "natural group" is "monophyletic," which means that a given lineage is discrete and ultimately can be traced back to a single originating branchpoint. A taxonomic group (such as a genus) that can be shown to have been derived directly as a specialized portion within some other lineage renders that lineage "paraphyletic" and should be reclassified as a subgroup of that lineage (or the whole thing should be split up into a series of discrete monophyletic groups). Taxonomic groups that include members of two or more distantly related lineages are categorized as "polyphyletic" and are not tolerated.

In large taxonomic groups, like the Asteraceae, the basic units (tribes, genera, and species) may be more or less recognizable morphologically based upon one or several unusual features. The relationships between these basic units has been a major focus of many recent systematic studies, and the number of tribes, genera, and species accepted in a classification often has been modified from traditional limits because new data have defined novel monophyletic groups.

In the Asteraceae, there has been a recent trend to split many of the larger traditional genera into series of smaller genera. This usually has come about because phylogenetic studies have resulted in a

different understanding of the relationships between groups of closely related species. In many cases in a given tribe, some species within Genus A may be more closely related to some species within Genus B than to other species within Genus A. For the larger genera having broad distributions on several continents, these relationships may not be evident if only the species in a regional flora are studied, but can become clearer when the entire genus across its whole provenance is analyzed for patterns of variation. Thus, in recent years, traditional genera of Asteraceae, such as *Cacalia, Senecio, Eupatorium, Gnaphalium, Solidago*, and *Aster*, have become dismembered by systematists into smaller putatively monophyletic units.

Perhaps none of these genera has received more taxonomic attention than *Aster*. When Steyermark's (1963) Flora of Missouri was published, most botanists considered it a taxonomically difficult genus of nearly 450 species distributed widely in temperate and montane regions of the world. Today, the situation is quite different, with all but 1 of the ca. 180 species remaining in the genus native to Europe and Asia. In the Flora of North America region, the native circumboreal *A. alpinus* L. (alpine aster) occurs from Alaska southward through the Rocky Mountains to Wyoming (and also in far northern Europe and Asia) and the non-native *A. tataricus* L. f. (Tatarian aster, a Eurasian native) escapes sporadically from cultivation in gardens. In advance of the second volume of the revised Steyermark's Flora of Missouri, the purpose of the present paper is to alert botanists in the state to the recent taxonomic disposition of the asters of Missouri.

The changes in generic delimitation of *Aster* have been developing for a long time. In the early 1970s, Bernard Boivin (1971–1972) of the University of Laval (Canada) was the first to recognize that the white upland aster (*A. ptarmicoides*) was more closely related to the species of the *Oligoneuron* group of goldenrods (*Solidago*) than to the other species of *Aster*. In the late 1970s, John Semple at the University of Waterloo (Canada) and his colleagues began developing new cytological and morphological data to support a narrower circumscription of the genus (see Semple et al. [2002] for a review). The revised classification began to stabilize with the thorough taxonomic and phylogenetic analysis of the group throughout its range by Guy Nesom (1994), then at the the University of Texas–Austin. More recent analyses by Nesom (reviewed in Nesom [2000]) and Semple (reviewed in Semple et al. [2002]) have have continued to support the hypothesis of a narrower generic concept of *Aster*. Ongoing molecular phylogenetic research (Noyes and Rieseberg, 1999; Semple et al.,

2002) also has supported this general reclassification of the *Aster* group while fine-tuning the numbers and limits of the various smaller genera.

It is beyond the scope of the present paper to detail the research supporting the current classification of the tribe Astereae. It is sufficient to note that Nesom (1994) and Noyes and Rieseberg (1999), using independent data sets, arrived at the conclusion that there was a basic phylogenetic branch toward the base of the group's evolutionary tree between Old World and New World lineages. As the generic name *Aster* originally was described based on Eurasian plants, if the New World group represents a different lineage it can no longer be be classified under the name *Aster*. Within the New World lineage of Asteraceae tribe Astereae subtribe Asterinae, Nesom (1994) and later authors have arrived at a classification that includes about 14 currently accepted genera, a few of which are still controversial in their circumscription. The justifications for maintaining each of these genera are discussed in Nesom's (2000) excellent review of the North and Central American genera of the tribe Astereae.

For Missouri, the practical consequence of this generic revision is that the native species are distributed among four genera. The largest of these (and the largest segregate in North America) is *Symphyotrichum*, which includes the core species of Missouri asters. The other genera accomodate asters that were separted toward the beginning of the keys to species determination in all of the floristic literature used by students of the state's flora until the present time. Thus, learning the new system will not be a difficult chore for most Missouri botanists once they accept the sad fact of the dismemberment of a genus that traditionally has been readily recognizable in the field and herbarium.

The revised nomenclature of the Missouri asters is listed below. It should be noted that three species have been reported as new to the state since Steyermark's (1963) flora was published (these are indicated in the checklist). A few of the species are listed under different species epithets than in the older literature, following more recent species-level taxonomic investigations by asterologists. Synonymy in the checklist is mostly restricted to the names used by Steyermark (1963), but additional synonyms are listed where necessary for clarity. Infraspecific classification within the accepted species is beyond the scope of the present paper. Readers should consult the forthcoming second volume of the revised Steyermark's Flora of Missouri for a detailed account of the varieties and subspecies of the Missouri species.

Finally, within *Solidago*, only the single species transferred from *Aster* is listed.

THE CURRENT NOMENCLATURAL STATUS OF THE MISSOURI ASTERS

Aster L.—Ca. 180 species, North America (1 native taxon), Europe, Asia.

1. Aster tataricus L.f. (Tatarian aster). Reported for Missouri by Yatskievych and Summers (1993)

Doellingeria Nees—Three species, U.S., Canada.

2. Doellingeria umbellata (Mill.) Nees (flat-topped white aster). Reported for Missouri (as *Aster pubentior* Cronquist) by Gremaud (1988)

Aster umbellatus Mill.

Eurybia (Cass.) S.F. Gray—Ca. 28 species, U.S., Canada, Europe, Asia.

3. Eurybia furcata (E.S. Burgess) G.L. Nesom (forked aster)

Aster furcatus E.S. Burgess

4. Eurybia hemispherica (Alexander) G.L. Nesom (single-stemmed bog aster, southern prairie aster)

Aster paludosus Aiton ssp. *hemisphericus* (Alexander) Cronquist

5. Eurybia macrophylla (L.) Cass. (large-leaved aster). Reported for Missouri by Summers and Yatskievych (1990)

Aster macrophyllus L.

Ionactis Greene—Ca. 5 species, U.S., Canada.

6. Ionactis linariifolius (L.) Greene (stiff aster, stiff-leaved aster, flax-leaved aster)

Aster linariifolius L.

Solidago L.—About 100 species, North America (23 in Missouri), South America, Europe, Asia.

7. Solidago ptarmicoides (Torr. & A. Gray) B. Boivin (white upland aster, sneezewort aster)

Aster ptarmicoides Torr. & A. Gray

Symphyotrichum Nees (aster)—Ca. 90 species, North America to South America.

8. Symphyotrichum anomalum (Engelm. ex Torr. & A. Gray) G.L. Nesom
Aster anomalus Engelm. ex Torr. & A. Gray

9. Symphyotrichum ciliatum (Ledeb.) G.L. Nesom (rayless alkali aster)
Aster brachyactis S.F. Blake

10. Symphyotrichum cordifolium (L.) G.L. Nesom (blue wood aster)
Aster cordifolius L.
Aster sagittifolius Wedem. ex Willd.

11. Symphyotrichum drummondii (Lindl. ex Hook.) G.L. Nesom (Drummond aster)
Aster drummondii Lindl. ex Hook.

12. Symphyotrichum dumosum (L.) G.L. Nesom
Aster dumosus L.

13. Symphyotrichum ericoides (L.) G.L. Nesom (wreath aster)
Aster ericoides L.

14. Symphyotrichum falcatum (Lindl.) G.L. Nesom (white prairie aster)
Aster commutatus (Torr. & A. Gray) A. Gray

15. Symphyotrichum laeve (L.) Á. Löve & D. Löve (smooth aster)
Aster laevis L.

16. Symphyotrichum lanceolatum (Willd.) G.L. Nesom (tall white aster, panicled aster)
Aster *simplex* Willd.

17. Symphyotrichum lateriflorum (L.) Á. Löve & D. Löve (white woodland aster)
Aster lateriflorus (L.) Britton

18. Symphyotrichum novae-angliae (L.) G.L. Nesom (New England aster)
Aster novae-angliae L.

19. Symphyotrichum oblongifolium (Nutt.) Nesom (aromatic aster, oblong-leaved aster)
Aster oblongifolius Nutt.

20. Symphyotrichum ontarione (Wiegand) G.L. Nesom (Ontario aster)
Aster ontarionis Wiegand

21. Symphyotrichum oolentangiense (Riddell) G.L. Nesom
(azure aster, blue devil)
Aster oolentangiensis Riddell
Aster *azureus* Lindl. ex Hook.

22. Symphyotrichum parviceps (Burgess) G.L. Nesom
(small white aster)
Aster parviceps (Burgess) Mack. & Bush

23. Symphyotrichum patens (Aiton) G.L. Nesom
(spreading aster, purple daisy)
Aster patens Aiton

24. Symphyotrichum pilosum (Willd.) G.L. Nesom
(white heath aster)
Aster pilosus Willd.

25. Symphyotrichum praealtum (Poir.) G.L. Nesom
(willow-leaved aster)
Aster praealtus Poir.

26. Symphyotrichum puniceum (L.) Á. Löve & D. Löve
(glossy-leaved aster)
Aster puniceus L.
Aster firmus Nees

27. Symphyotrichum racemosum (Elliott) G.L. Nesom
(small white aster, frost flower)
A. vimineus Lam., misapplied

28. Symphyotrichum sericeum (Vent.) G.L. Nesom
(silky aster)
Aster sericeus Vent.

29. Symphyotrichum subulatum (Michx.) G.L. Nesom
(inland saltmarsh aster, freeway aster)
Aster subulatus Michx.
Aster exilis Elliott

30. Symphyotrichum turbinellum (Lindl. ex Hook.)
G.L. Nesom (prairie aster)
Aster turbinellus Lindley

31. Symphyotrichum urophyllum (Lindl. ex DC.)
G.L. Nesom
Aster urophyllus Lindl. ex DC.
Aster *sagittifolius* Wedem. ex Willd., misapplied

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